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the equations deduced. In a following paper discussing Young and Forbes' experiments in which the velocity of violet light apparently exceeds the velocity of red light by 1.8 per cent., Rayleigh again accentuates the difference between the group velocity and the individual velocity of waves. The last optical paper in the volume reopens the question relative to the production of a truly compound yellow made of red and green, and treats other questions of similar psychological interest. The concluding paper of the book is an investigation in pure elastics, dealing with the infinitesimal bending of surfaces of revolution, with particular reference to the theory of bells.

I am of course well aware that the account which I have endeavored to give of this great book is altogether inadequate; but with such an exuberance of material, and so much of it expressed either in untractable equations or in a style admitting of expansion only, all attempts are foredoomed. Besides the larger papers which I have mentioned, there is a bewildering array of smaller articles, sententious criticisms or suggestions mathematical or not, theorems, special solutions, computations, etc. Some of Lord Rayleigh's most helpful services to science are to be found in these current notes and as a rule they are hard to find. For this reason the present complete republication of his works is additionally to be welcomed.

Rayleigh's style is exquisitely terse. Even those papers which are free from mathematics are not easy reading. The endeavor to make a clear statement more intelligible is rarely thought worth while. The greater number of papers are short. The average 7 pages each (78 papers in the 562 pages of this first volume). Withal it is a book to which one may come for fundamental originality, but one must expect to pay for the privilege. It is pleasant to note that Rayleigh cheerfully gives credit to the labors of others and not only to those of his own nation. But however genial his criticism it is none the less keen. Errors are virtually dismembered with a few deft strokes, and the incident passes before there is time to cry for mercy. On the whole a wise man will think twice before he disagrees with the author of these 'Scientific Papers.'

Lord Rayleigh is not quite as radical as some of the other English mathematicians in eschewing formulated mathematics as far as possible, a method which those of us who do not aspire to become too mathematical for mathematics, cannot but regret—at least when we have practical occasions for following the argument. There is moreover something amusing about this fashion of verbally treating abstruse mathematical doctrine. Our host, as it were, receives us at his ease, quite unarmed, and discusses the most delicate matters with complete nonchalance. But nobody is deceived. One may be quite sure that a strong man, armed cap-à-pie, is hidden away somewhere in the closet. When mathematics becomes verbal one feels that she is speaking a foreign tongue and that something is actually being translated. The original would be far preferable.

On closing the book one can not but wonder how much talk could be made out of a single page of it; or perhaps more graciously, how immensely science would be benefited if the bulk of what is now rampant were to shrink to the standard of Lord Rayleigh's text.

CARL BARUS.

BROWN UNIVERSITY,
PROVIDENCE, R. I.

System der Bakterien. By PROFESSOR W. MIGULA. Handbuch der Morphologie, Entwicklungsgeschichte und Systematik der Bakterien. Bd. II. Spezielle Systematik der Bakterien. Jena, Gustav Fischer. 1900. Pp. 1068, pl. 18, figs. 35.

The working bacteriologist has long been in need of some treatise that would enable him to trace to the original description at least a fair proportion of the 'species' and 'varieties' that he finds referred to in the literature of the day. It is one of the great stumbling-blocks in bacteriology that a bewildering multiplication of names and synonyms has taken place during the last decade and has had its natural result in an almost hopeless confusion of bacteriological classification and nomenclature.

The great task essayed by Professor Migula may well command respect and admiration. Not only is enormous mechanical labor involved in the extracting and collecting of 1200

descriptions of bacterial species from many widely scattered books and special monographs, but the orderly arrangement of these descriptions, many of them imperfect and fragmentary, is a labor calculated to daunt any but Teutonic patience. That the task has been accomplished in such a satisfactory fashion by Professor Migula is matter for general congratulation.

There doubtless exist differences of opinion among bacteriologists as to how far systematists should carry out the process of welding together descriptions of species. There can be no question that many of the 'species' now masquerading under different titles are in reality identical and should be grouped under one name. On the other hand, it is equally true that forms now classed as 'varieties' are actually distinct and may be shown by future investigators to be widely separated. Two opposite tendencies are plainly visible among bacteriologists concerned in work of this character—and all bacteriologists are sooner or later brought face to face with the question of the 'identity' of the forms with which they are working: the tendency to magnify physiological differences and erect into new species or varieties those forms showing even slight divergence, and the tendency to ignore minor physiological characters and to include closely allied organisms under one species or group-name. Much more detailed study of the natural varieties of bacteria and of their plasticity under artificial conditions is necessary, however, before the true path can be surely determined.

The course pursued by Professor Migula in this matter is likely to command general approval. It will probably be more useful at the present stage of our knowledge to possess a convenient and accurate record of all descriptions by all writers than to have an elaborate tabulation that has been subjected to too much revision and consolidation. At the same time it may be questioned whether it is necessary or advisable to include in a work of the highest standard, descriptions glaringly imperfect and defective, so imperfect in fact that identification and evaluation are not now and never can be possible. The pages of the *System der Bakter-*

ien might well be pruned of much dead and useless material of this nature.

The permanent value of a text of this sort can be thoroughly tested only by continual practical use, and it would be a work of supererogation to seek for the minor sins of omission and commission which any work dealing with bacterial classification must at present necessarily contain. One regrettable, but perhaps pardonable oversight only need be mentioned. The careful descriptions of a large number of water bacteria by two American bacteriologists, Wright (Memoirs National Academy of Sciences, VII., 1895) and Ravenel (Memoirs National Academy of Sciences, VIII., 1896) have evidently not come under the author's notice. Omissions of an important character are, however, surprisingly few and Professor Migula's great treatise will long remain the standard work in systematic bacteriology.

EDWIN O. JORDAN.

SCIENTIFIC JOURNALS AND ARTICLES.

Bird Lore for April opens with a description of 'A New Camera for Bird Photographers,' by the designer, John Rowley. 'Photographing a Robin' is described by A. L. Princehorn and 'How a Marsh Hawk Grows' is told by P. B. Peabody. In an article on 'The Egret Hunters of Venezuela,' George K. Cherrie shows the 'egret farms' of which we have heard are purely mythical and that the gathering of shed egret feathers is simply an incident in the work of the plume hunters. Marion E. Hubbard describes 'Bird Work at Wellesley College' and the balance of the number is given over to notes, correspondence, book reviews and reports of Audubon Department. The editor discusses the amendment to the law designed to protect non-game birds.

The Plant World for March begins with an amusing article on 'Popular Ignorance concerning Botany and Botanists,' by Aven Nelson. T. H. Kearney discourses 'Concerning Saxifrages.' A. M. Curtiss tells of 'The Water Hyacinth in Florida.' A. Wetzstein of 'The Velvet Dogbane in Ohio,' and L. H. Pammel of 'The Twin-Leaf (*Jeffersonia diphylla*) in Iowa.' Under 'Plant Juices and their Commercial